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A liquid level control device and watering system

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(56) Related Art  
EP 108241  
GB 2095083  
DE 3020915

*Problem  
for claim 1  
but claim 2 OK.  
i.e. AU 1776  
not hydraulically  
actuated.*

## ABSTRACT

A liquid level control device (10) for controlling the level of liquid in a vessel (12) includes a housing (14) having a chamber (20) with an opening (22) for the ingress or egress of liquid, an inlet (24) for liquid to enter the chamber (20) under the control of a valve (16), and a float (18) pivotally mounted to the housing (14) inside the chamber (20). The float (18) is associated with the valve (16) so that when the liquid level within the vessel (12) is less than a predetermined cut-off level the valve (16) is opened and when the liquid level reaches the cut-off level the valve (16) is closed. The float (18) is adapted to provide fluid communication between the inside of the float and the outside of the float. A plant watering system using the liquid level control device is also disclosed.

**CLAIMS**

**The Claims Defining the Present Invention are as Follows:**

1.           A liquid level control device for controlling the level of liquid in a vessel,  
5   said device including:  
              a housing having a chamber, the chamber having an opening for ingress or  
              egress of liquid from the housing;  
              an inlet for liquid to enter the chamber under the control of a valve;  
              a float pivotally mounted to the housing inside the chamber, the float being  
10   associated with the valve so that when the liquid level within the vessel is less than a  
              predetermined cut-off level the valve is opened and when the liquid level reaches the cut-  
              off level the valve is closed, wherein the float is adapted to provide fluid communication  
              between the inside of the float and the outside of the float.
- 15   2.           A liquid level control device according to claim 1, wherein the valve  
              includes a cylinder with a restricted opening at one end for allowing liquid to pass from  
              the inlet, through the cylinder and into the chamber the cylinder provided with one or  
              more inwardly directed projections so as to space the plunger from the inner  
              circumferential surface of the cylinder to provide a constantly open passage for the flow of  
20   liquid through the cylinder when the plunger is below the cut-off level, and  
              a plunger with a head, the plunger situated within the cylinder and  
              moveable within the cylinder as the float is raised and lowered by the fluid level,  
              wherein the head abuts and closes the restricted opening when it is moved within the  
              cylinder to a position where the float is at the cut-off level thereby closing the valve.
- 25   3.           A plant watering system including:  
              a tray having a plurality of receptacles for holding liquid, each receptacle  
              adapted to receive a potted plant,  
              the tray also having a vessel in liquid communication with each of the  
30   receptacle by means of at least one channel so as to received a water supply in each  
              receptacle,



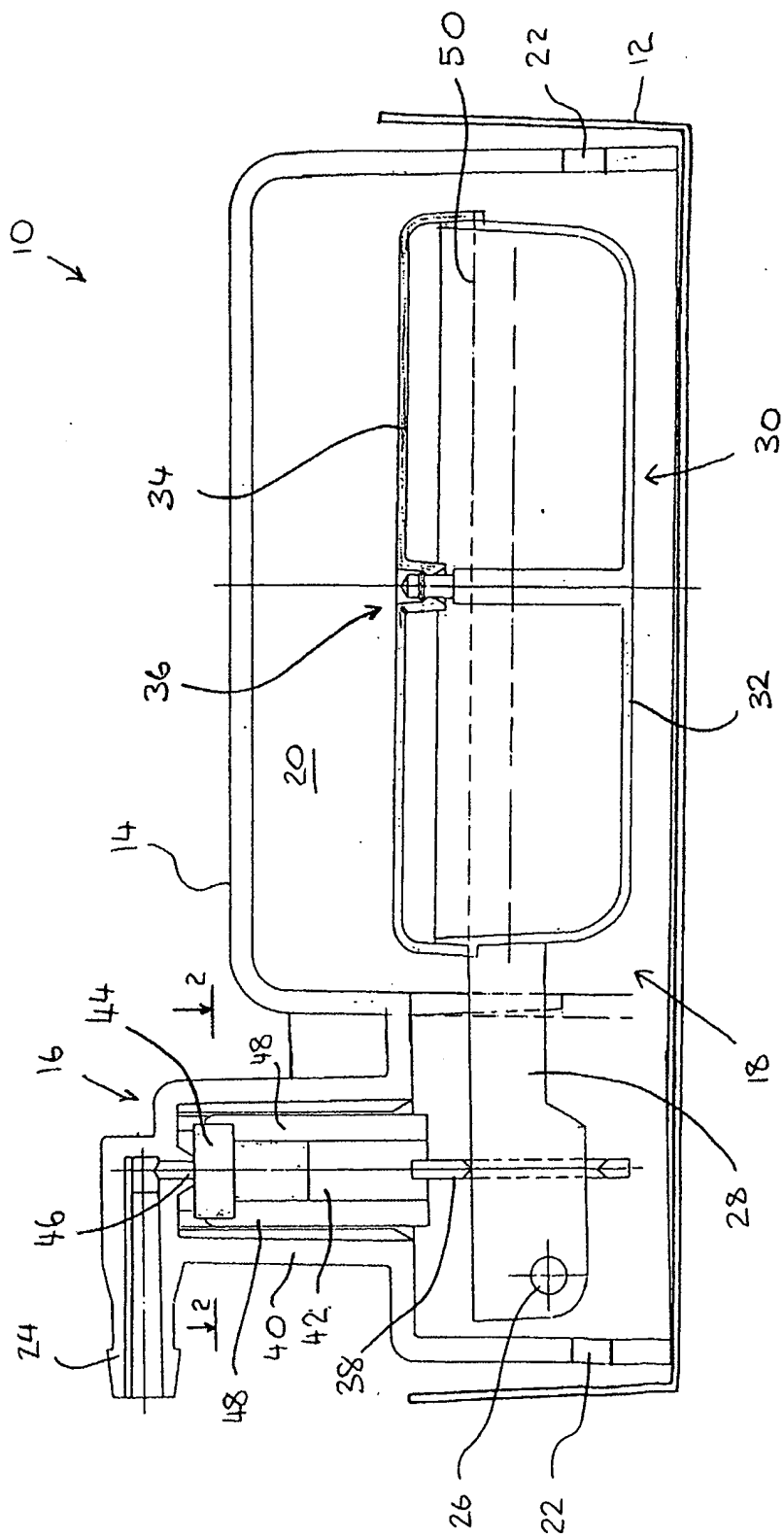


FIG. 1

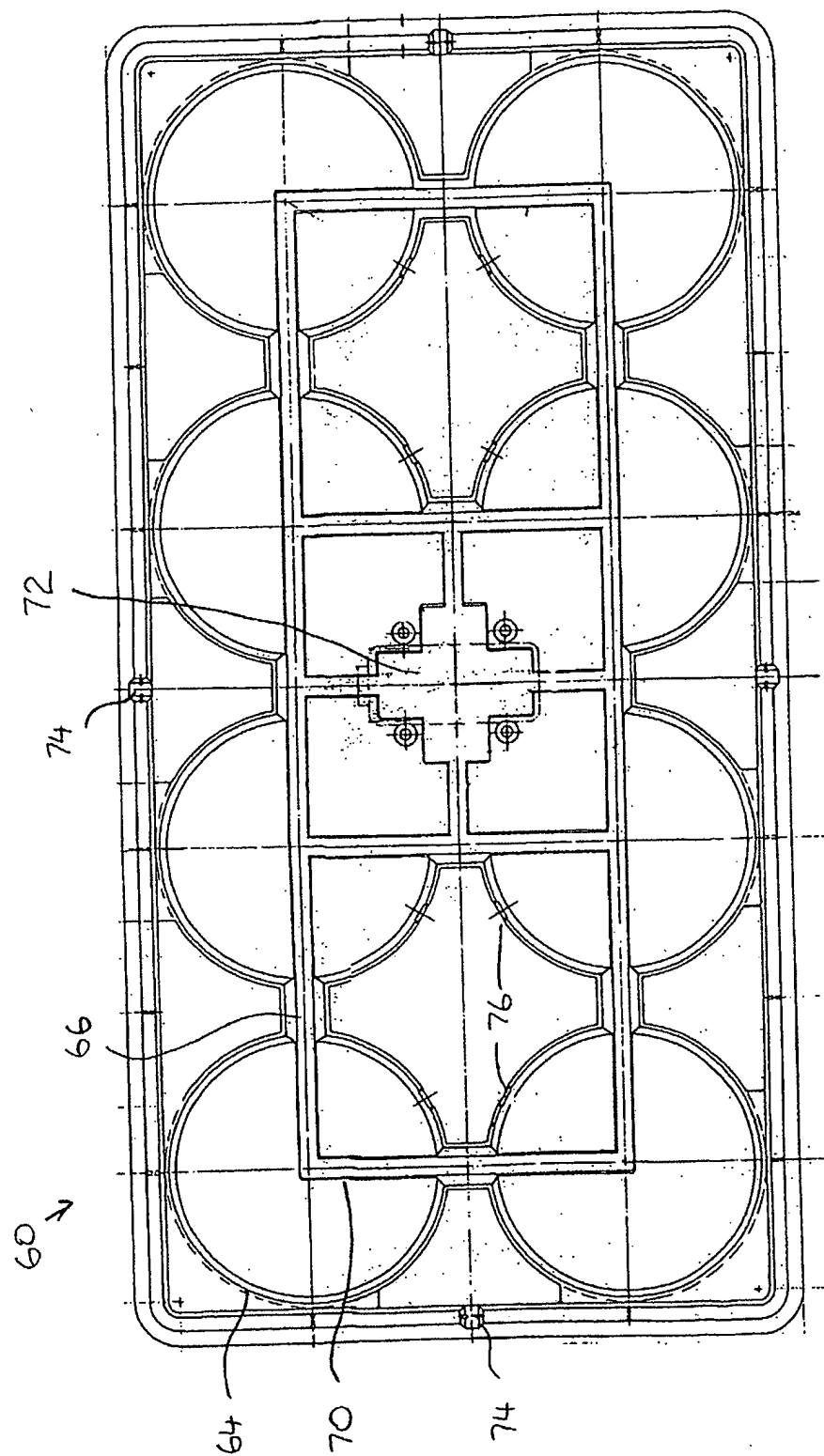


FIG. 4

**AUSTRALIA**

**PATENTS ACT 1990**

**COMPLETE SPECIFICATION FOR A  
PETTY PATENT**

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Petty Complete Specification for the Invention entitled:

**A LIQUID LEVEL CONTROL DEVICE AND WATERING SYSTEM**

Details of Associated Provisional Applications Nos:

Details of Parent Application for Divisional Application:

The following is a full description of this invention, including the best method of performing it known to me:-

## A LIQUID LEVEL CONTROL DEVICE AND WATERING SYSTEM

The present invention relates to a device for controlling the level of liquid in a vessel and a watering system for potted plants.

Nurseries spend a lot of money watering and fertilising their plants. Often this is conducted by use of a sprinkler system which sprays water combined with fertiliser over an area containing plants in pots. However, a lot of the water is wasted because it is not caught by the pots and enters the ground. This wastage represents an additional cost to the nursery, not only for the cost of the water but also the cost of fertiliser. This can also cause other problems as the fertilised water can seep into the ground water thereby contaminating ground water.

Automated watering systems have been developed to only provide the amount of water and nutrients needed by the plant. The automated watering systems often have a requirement that the water level must be kept relatively constant. Here a liquid level control device is used to maintain the water at the appropriate level. Such a device is described in Australian patent application No. 21106/92 however, this device is quite complicated.

In addition, the liquid level control device is subjected to normal ambient temperature variations. Temperature variations can effect the liquid level control device in a number of ways, including the float within the liquid level control device expanding relative to a housing that houses the float. The expansion of the float can reach the point where the float becomes jammed inside the housing. In addition, the liquid level control device contains a valve. Again, the temperature variation can cause a plunger inside the valve to expand relative to the chamber the plunger is within. This can cause the plunger to jam within the chamber thereby inhibiting proper functioning of the liquid level control device.

The present invention seeks to overcome, at least to some extent, the above mentioned problems.

In accordance with a first aspect of the present invention there is provided a liquid level control device for controlling the level of liquid in a vessel, said device including:

- 5 a housing having a chamber, the chamber having an opening for ingress or egress of liquid from the housing;
- an inlet for liquid to enter the chamber under the control of a valve;
- a float pivotally mounted to the housing inside the chamber, the float being associated with the valve so that when the liquid level within the vessel is less than a predetermined cut-off level the valve is opened and when the liquid level
- 10 reaches the cut-off level the valve is closed, wherein the float is adapted to provide fluid communication between the inside of the float and the outside of the float.

Preferably, the valve includes a cylinder with a restricted opening at one end for allowing liquid to pass from the inlet, through the cylinder and into the chamber the cylinder provided with one or more inwardly directed projections so as to space the

15 plunger from the inner circumferential surface of the cylinder to provide a constantly open passage for the flow of liquid through the cylinder when the plunger is below the cut-off level, and

- a plunger with a head, the plunger situated within the cylinder and moveable within the cylinder as the float is raised and lowered by the fluid level,
- 20 wherein the head abuts and closes the restricted opening when it is moved within the cylinder to a position where the float is at the cut-off level thereby closing the valve.

Preferably, the float includes a positive buoyancy portion in the form of a container with a removable lid. Preferably, the positive buoyancy portion is marginally smaller than the vessel in plan view.

- 25 Preferably, the float includes a pivotal arm, at one end of the arm is the positive buoyancy portion. Preferably, a collar member engages the arm at a position where upward or downward movement of the positive buoyancy portion causes a corresponding upward or downward movement of the collar portion. Preferably, the collar portion is coupled to the plunger of the valve to transfer movement of the float

to the plunger. Preferably, the float is arranged to be a predetermined distance above the bottom of the vessel when the liquid level is at the cut-off level.

Preferably, the projections extend down the length of the cylinder. Preferably, the head is wider than the remainder of the plunger. Preferably, the plunger is located  
5 directly above the collar member, so that upward movement closes the valve and downward movement opens the valve.

Preferably, the cut-off level can be adjusted by varying the location the float is pivotally mounted to the housing.

According to a second aspect of the present invention there is provided a plant  
10 watering system including:

a tray having one or more receptacles for holding liquid and adapted to receive a potted plant,

the tray also having a vessel in liquid communication with each of the receptacle by means of at least one channel,

15 the vessel having a liquid level control device for controlling the level of liquid in the receptacles,

the liquid level control device connected to a supply of liquid. Typically the liquid supply includes water. Preferably, the liquid supply also includes nutrients.

20 Preferably, the receptacles are arranged to space the pots a short distance from the base of the receptacles to allow access of the fluid to the pot holes. Alternatively, the at least one channel extends through the base of the receptacle so that water may access the pot holes.

Preferably, the tray includes a receiver for holding the liquid level control device.  
25 More preferably, the receiver is arranged to orient the liquid level control device in a plurality of directions with respect to the receptacles.

Preferably, the tray includes eight receptacles arranged in a 4 x 2 configuration. Preferably, the tray includes a plurality of clipping means, each clipping means arranged to hold a pipe supplying the liquid to the liquid level control device for each configuration.

- 5      Preferably, the plant watering system includes a carrier for holding a plurality of potted plants, the carrier adapted to engage with the tray so that the plants are watered, the carrier also adapted to disengage with the tray so that the potted plants may be carried in the carrier.

10      Preferably, the carrier includes at least one hole in its base to allow water in the receptacles access to the pot holes in each pot.

In order to provide a better understanding, the present invention will now be described with reference to the accompanying drawings in which:

- Figure 1      is a cross-sectional side view of a preferred form of a liquid level control device;
- 15      Figure 2      is a cross-sectional view of a valve of the liquid level control device of Figure 1;
- Figure 3      is a plan view of a preferred form of a plant watering system in accordance with the present invention; and
- Figure 4      is a plan view of an alternative form of the plant watering system in accordance with the present invention.
- 20

Referring to Figure 1, there is shown a liquid level control device 10 located in a vessel 12. The liquid level control device 10 includes a housing 14, a valve 16 and a float 18. The housing 14 includes a chamber 20 and openings 22 which allow for the ingress or egress of liquid from the housing 14. The liquid level control device

25      10 also includes an inlet 24.

The float 18 includes a positive buoyancy portion 30 which is pivotally mounted at the end of arm 28 to the housing 14 at pivot point 26. The positive buoyancy

portion 30 is in the form of a container 32 having a lid 34. The lid 34 is not sealed with the container 32 thus providing fluid communication between the inside and the outside of the float 18. The positive buoyancy portion 30 is able to float on liquid in the vessel 12. As the level of liquid within the vessel 12 rises and lowers the height of the portion 30 is raised or lowered. This may be adjusted by moving the position of the pivot point 26.

Coupled to the arm 28 is a collar member 38. The collar member 38 is coupled to the arm 28 a distance from the pivot point 26 so that as the positive buoyancy portion 30 raises and lowers with the liquid level in the vessel 12 the collar member 38 also is raised and lowered.

The valve 16 includes a cylinder 40 within which is a plunger 42. The plunger 42 has a head 44 larger in diameter than the remainder of the plunger 42. The plunger 42 is coupled to the collar member 38 so that as the collar member 38 is raised and lowered by the positive buoyancy portion 30, the plunger 42 is also raised and lowered. At the end of the cylinder 40 further most from the collar member 38 is a restricted opening 46. This allows liquid from the inlet 24 to enter the cylinder 40. The head 44 of the plunger 42 is adjacent the restricted opening 46. As the plunger 42 is raised the head 44 abuts and closes the restricted opening 46. In this position the valve 16 is closed, stopping the flow of liquid from the inlet 24 into the housing 14. As the plunger 42 is lowered the head 44 moves away from the restricted opening 46 and the valve 16 becomes open, thereby allowing liquid from the inlet 24 into the housing 14.

As seen in Figure 2, the cylinder 40 has a number of projections 48 extending inwardly. The projections 48 extend toward the centre of the cylinder 40 by a distance just short of the remainder of the plunger 42. This is so that the plunger 42 can still freely move up and down within the cylinder 40, but also allows liquid to pass through the gaps between the projections 48 if the plunger becomes stuck.

Referring to Figure 3, there is shown a plant watering system 60 which includes a



tray with a number (in this instance 8) receptacles 64 for holding liquid and for receiving a potted plant. The tray also has a vessel 12 within which the liquid level control device 10 controls the level of liquid within the vessel 12 and consequently the receptacles 64. The vessel 12 is in liquid communication with each of the  
5 receptacles 64 by channels 66. That is, liquid can flow from the vessel 12 through one or more channels 66 and possibly one or more receptacles to a receptacle 64 which is lower in water. The vessel 12 and each of the receptacles 64 are arranged to be one the same level so that the liquid level within the vessel 12 and receptacles 64 can be kept the same. Preferably, the tray is placed on a level surface so that the  
10 liquid level and each of the receptacles can be kept even. Each of the receptacles may include a plurality of upright projections to space the pot received by the receptacle from the back of the receptacle so that liquid can access a hole in the pot and therefore can water the plant within the pot.

The receptacle 64 may be slightly conical in shape so that the centre of the  
15 receptacle 64 is slightly lower than the circumference of the base of the receptacle 64.

Referring to Figure 4, there is shown an alternative version of the plant watering system 60. Like numbers represents like features from Figure 3. The tray 60 includes a receiver 72. The receiver 72 is arranged so that the liquid level control  
20 device 10 may be oriented within the tray in four different directions. That is, longitudinally of the tray in one direction or the other, or transverse the length of the tray in one direction or the other. The periphery of the tray includes a clipping means 74 for each orientation of the liquid level control device 10. Each clipping device 64 is for clipping a pipe 62 that provides liquid supply to the liquid level  
25 control device 10.

If the pot is smaller than the receptacle 64 it sits within a holding means, such as a clip may be provided to prevent the pot from being tipped or blown over by the wind.

The method of operation and use of the present invention will now be described with reference to the accompanying drawings.

5 The liquid level control device 10 is situated within the vessel 12 and connected with a hose or pipe which is connected to the inlet 24 to supply liquid, such as water, to the liquid level control device 10. The level to which the liquid is to be filled within the vessel 12 is also known as the cut-off level and is shown as 50 in Figure 1.

10 If the liquid level in the vessel is less than the cut-off line 50 the positive buoyancy portion 30 will float relatively lower within the vessel 12. This will mean that the collar member 38 is moved downward and thus the plunger 42 will also be moved downward. The downward positioning of the plunger 42 will move the head 44  
15 away from the restricted opening 46 allowing fluid to enter the cylinder 40, pass the plunger 42 and enter the chamber 20. The fluid may then pass out of the openings 22 and fill the vessel 12 up to the cut-off level 50. As the liquid level increases the height of the float 18 within the vessel 12 will increase up to the point where the liquid level reaches the cut-off level 50. At this point the height of the collar portion  
20 and thus the plunger 42 will be raised up enough so that the head 44 abuts the restricted opening 46 to close it thereby closing the valve 16 and cutting off the supply of liquid entering the chamber and thus the vessel 12 by the openings 22.

20 Fluid flowing into the vessel 12 may flow via channel 66 and possibly one or more receptacles 64 so that the liquid level in each of the receptacles 64 is even. A plant drawing water through the pothole out of the receptacle 64 will lower the water level within that receptacle which will cause the water level to be lowered within the vessel 12 and thus the valve 16 within the liquid level control device 10 will open thereby re-adjusting the liquid level back to the cut-off level 50.

25 A carrier may be engaged with the receptacles of the tray so that potted plants may sit within the carrier which then sits within each of the receptacles 64. Thus, while the pot plants are within the carrier and within the tray the plants are supplied with water. The carrier may then be lifted and disengaged from the tray so that the plants

may be conveniently carried together.

Due to the size of pots varying the tray may be quite large in size and it may be more convenient to reorient the liquid level control device 10 within a receiver 72 rather than  
5 move the tray. In this case, the tray need not be moved but the angle from which the liquid is sourced may be changed. The hose providing the liquid source may be clipped within clip means 74 so that it is secured in place.

Since a large number of pot plants are located out doors they can be subject to fairly major  
10 variations in ambient temperature. Temperature variations can cause the expansion or contraction of parts within the liquid level control device 10. This can often lead to the parts becoming jammed within the liquid level control device 10 thus preventing it from functioning properly. To overcome this possibility, the positive buoyancy portion 30 can  
15 provide the communication of air from the inside of the container to the outside thus minimising the effects of contraction and expansion due to temperature variation and further minimising the risk of the positive buoyancy portion 30 becoming jammed within the housing 14.

Further, the plunger 42 can expand and contract with respect to the cylinder 40. To  
20 minimise the chances of jamming, the projections surround the plunger 42, while at the same time provide minimal contact with the head 44 so that the risk of jamming is minimised. In the event of a jam, when the water level is below the cut-off level, the water may still enter the vessel by travelling through the gaps between the projections.

25 Now that the preferred embodiments have been described, it will be apparent to the skilled addressee that the present invention has at least the following advantages:

- (1) There is a reduced risk of parts within the liquid level control device becoming jammed and thus preventing the correct operation of the liquid level control device;
- 30 (2) In the event of a jam the plants will still receive liquid; and,
- (3) The direction of the source of fluid can be varied without the need of either removing plants from the tray or turning the tray, particularly



when large sized pots are in the tray. Pots can be conveniently removed and carried by a carrier which engages with the tray to provide water and is also able to be disengaged so that the pots can be carried.

- 5 Modifications and variations can be made to the present invention without departing from the inventive concept, such as:

the container or the float need not be provided with a lid;

the cut-off level may be varied by altering the buoyancy of the positive buoyancy portion;

- 10 the components can be conveniently manufactured of plastics or other suitable material;

the number and orientation of the receptacles of the tray may be varied.

- 15 Such modifications and variations are deemed to be included within the scope of the present invention, the nature of which is to be determined from the foregoing description.

CLAIMS

**The Claims Defining the Present Invention are as Follows:**

1.           A liquid level control device for controlling the level of liquid in a vessel,  
5   said device including:  
              a housing having a chamber, the chamber having an opening for ingress or  
              egress of liquid from the housing;  
              an inlet for liquid to enter the chamber under the control of a valve;  
              a float pivotally mounted to the housing inside the chamber, the float being  
10   associated with the valve so that when the liquid level within the vessel is less than a  
              predetermined cut-off level the valve is opened and when the liquid level reaches the cut-  
              off level the valve is closed, wherein the float is adapted to provide fluid communication  
              between the inside of the float and the outside of the float.
- 15   2.           A liquid level control device according to claim 1, wherein the valve  
              includes a cylinder with a restricted opening at one end for allowing liquid to pass from  
              the inlet, through the cylinder and into the chamber the cylinder provided with one or  
              more inwardly directed projections so as to space the plunger from the inner  
              circumferential surface of the cylinder to provide a constantly open passage for the flow of  
20   liquid through the cylinder when the plunger is below the cut-off level, and  
              a plunger with a head, the plunger situated within the cylinder and  
              moveable within the cylinder as the float is raised and lowered by the fluid level,  
              wherein the head abuts and closes the restricted opening when it is moved within the  
              cylinder to a position where the float is at the cut-off level thereby closing the valve.
- 25   3.           A plant watering system including:  
              a tray having a plurality of receptacles for holding liquid, each receptacle  
              adapted to receive a potted plant,  
              the tray also having a vessel in liquid communication with each of the  
30   receptacle by means of at least one channel so as to received a water supply in each  
              receptacle,



the vessel having a liquid level control device according to claim 1 for  
controlling the level of liquid in the receptacles.

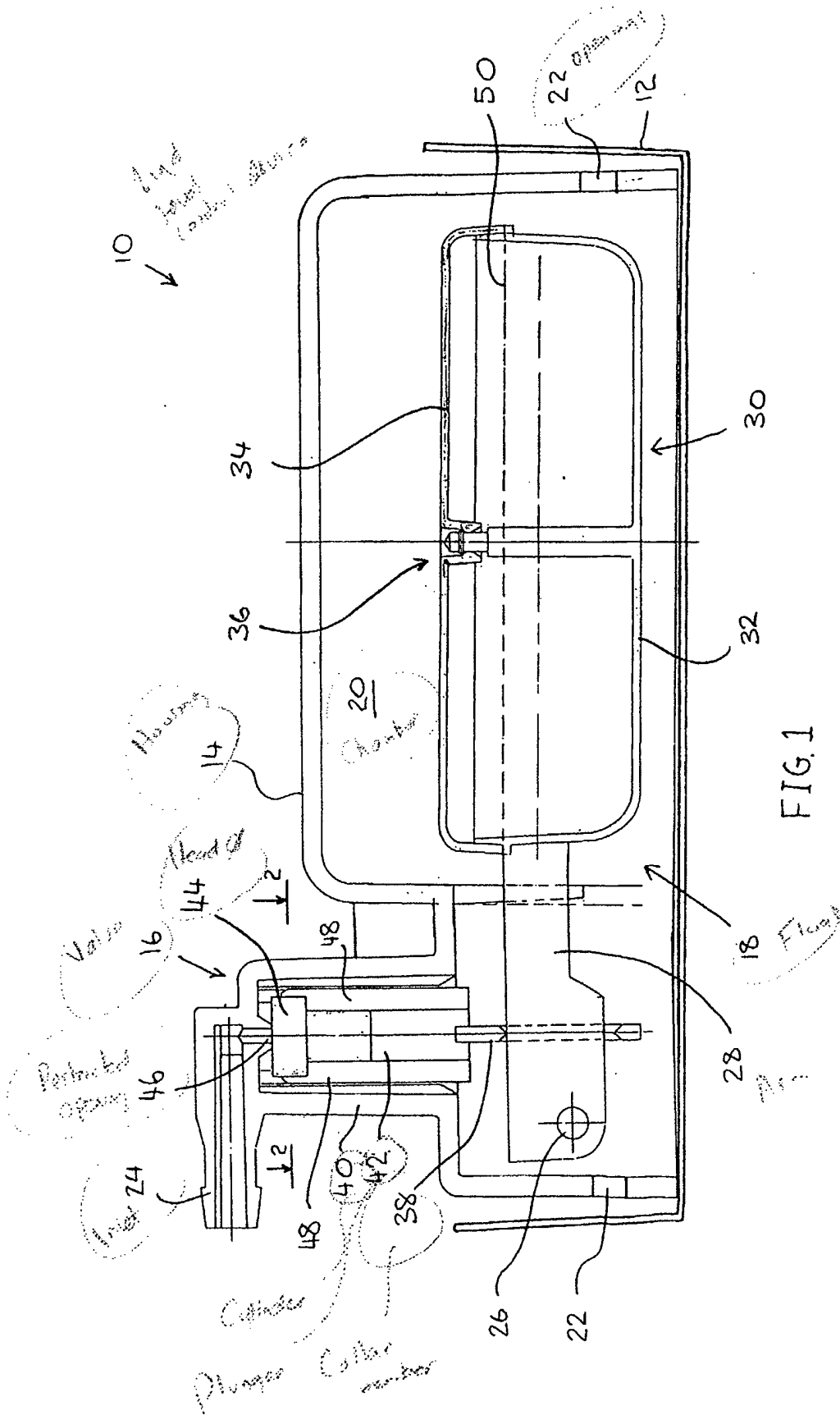
Dated this 8<sup>th</sup> day of February 2000.

5

**PREMIUM PLASTICS PTY LTD**  
By Their Patent Attorneys

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Fellows Institute of Patent and Trade Mark  
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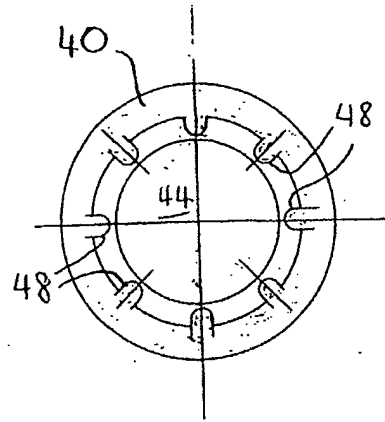


FIG. 2

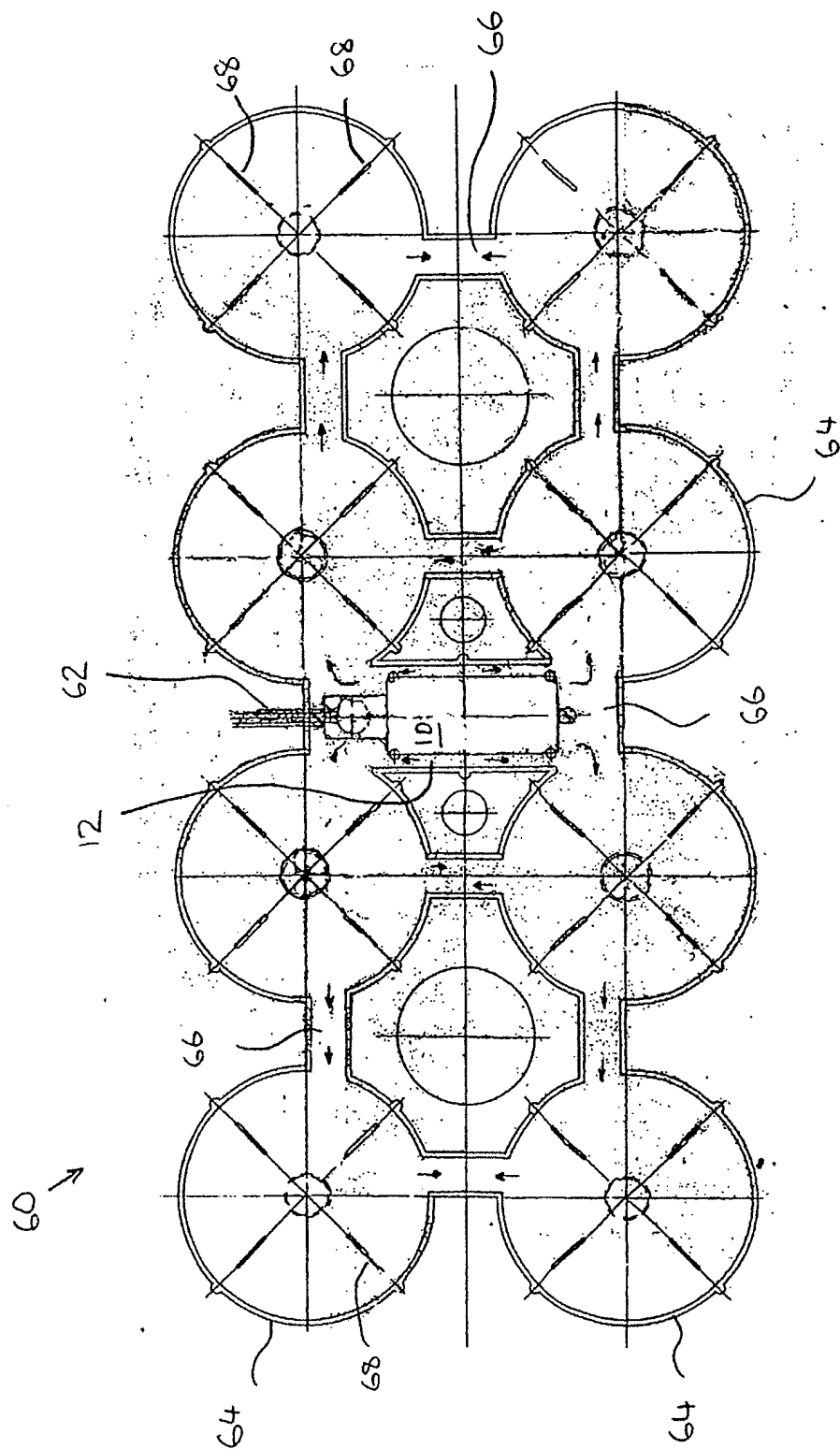


FIG. 3

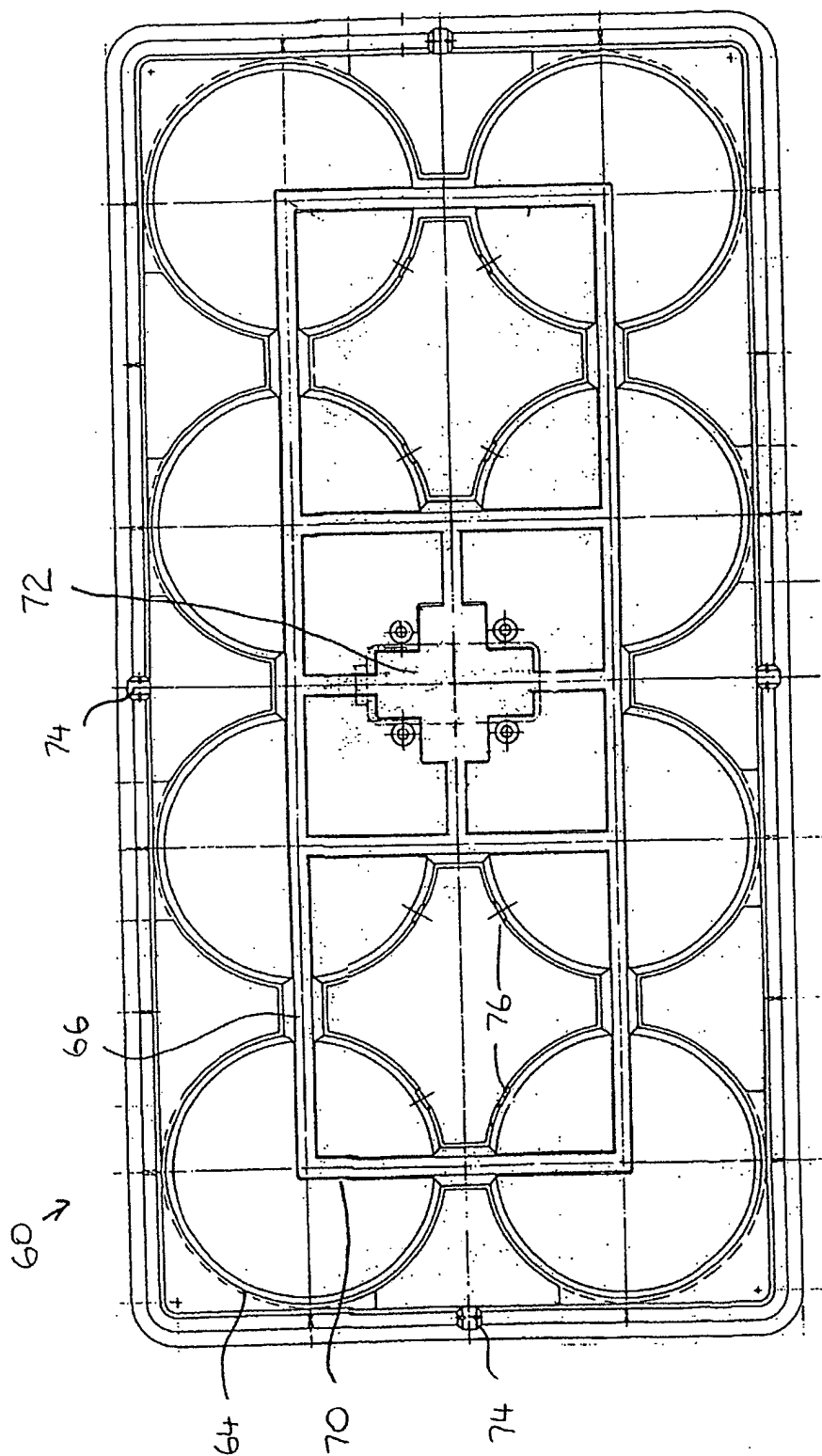


FIG. 4